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(54) **SINGLE MULTI-CHIP LAMP SOURCES AND RELATED METHODS**

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F21Y 101/02 (2006.01)
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(58) **Field of Classification Search**

USPC 362/231, 184, 249.02, 249.05, 249.06, 362/249.12, 249.14, 235, 310; 257/98-100
See application file for complete search history.

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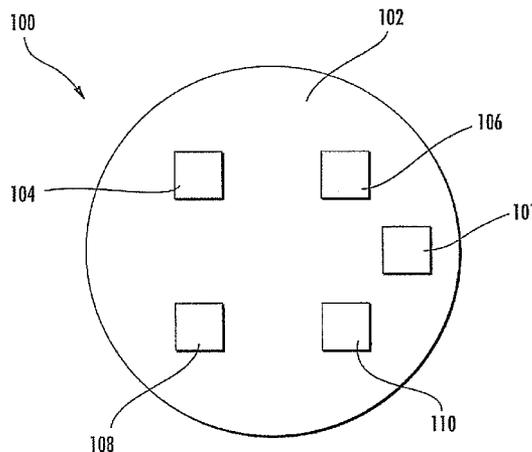
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(57) **ABSTRACT**

Multi-chip sources and related methods are disclosed. A single multi-chip lamp source can include a substrate and at least three light emitting diode (LED) chips operably configured to the substrate to form a single LED package. The LED chips can include at least three different colored LED chips. The LED chips can be configured to be actuatable either individually or together to provide selectable colored light beams. The LED chips can be positioned on the substrate such that an emitted light beam remains concentric without shifting regardless of the chip or chips emitting the light beam.

35 Claims, 5 Drawing Sheets



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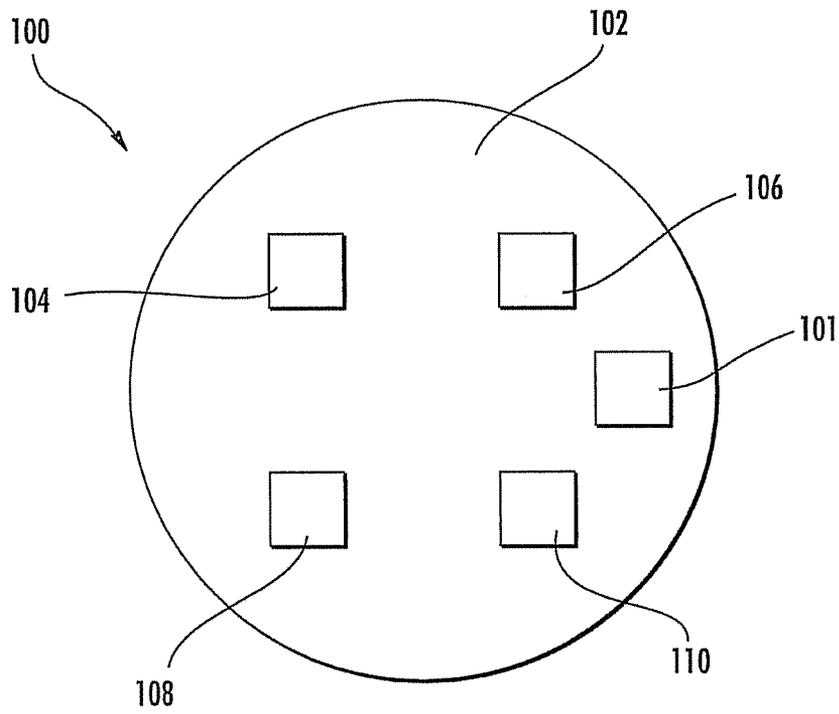


FIG. 1

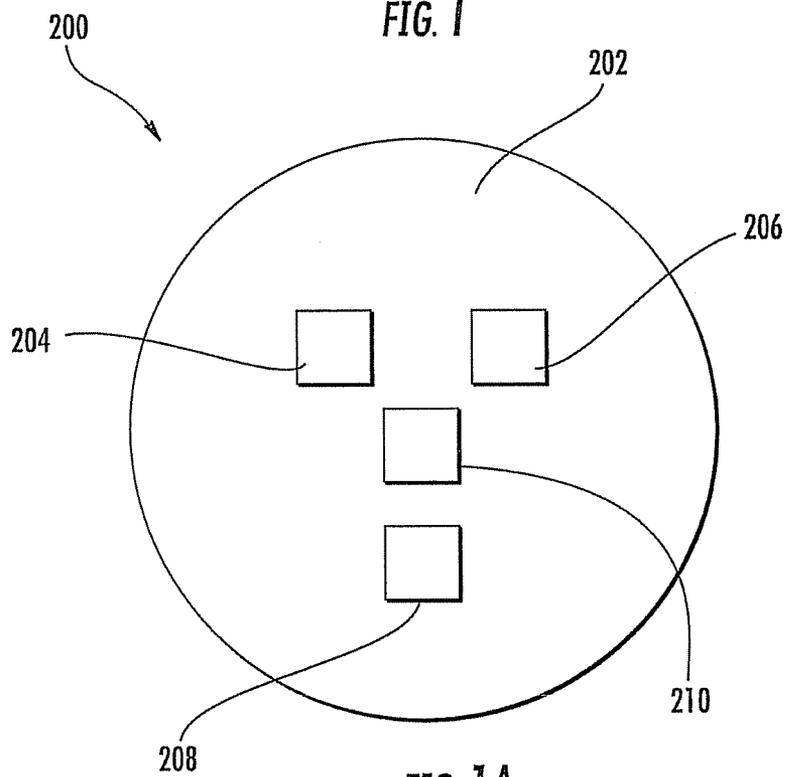


FIG. 1A

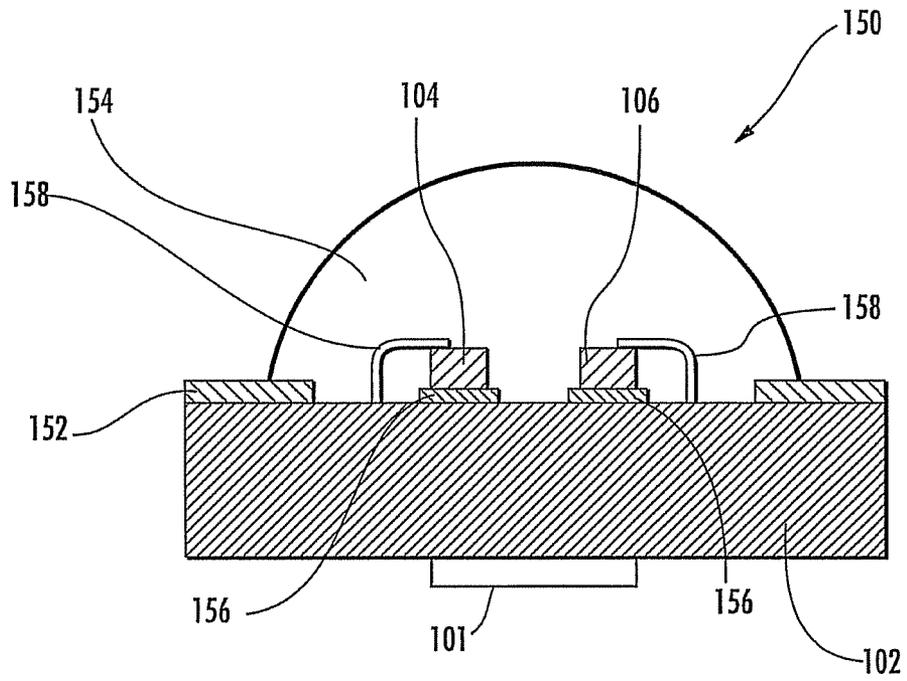


FIG. 2

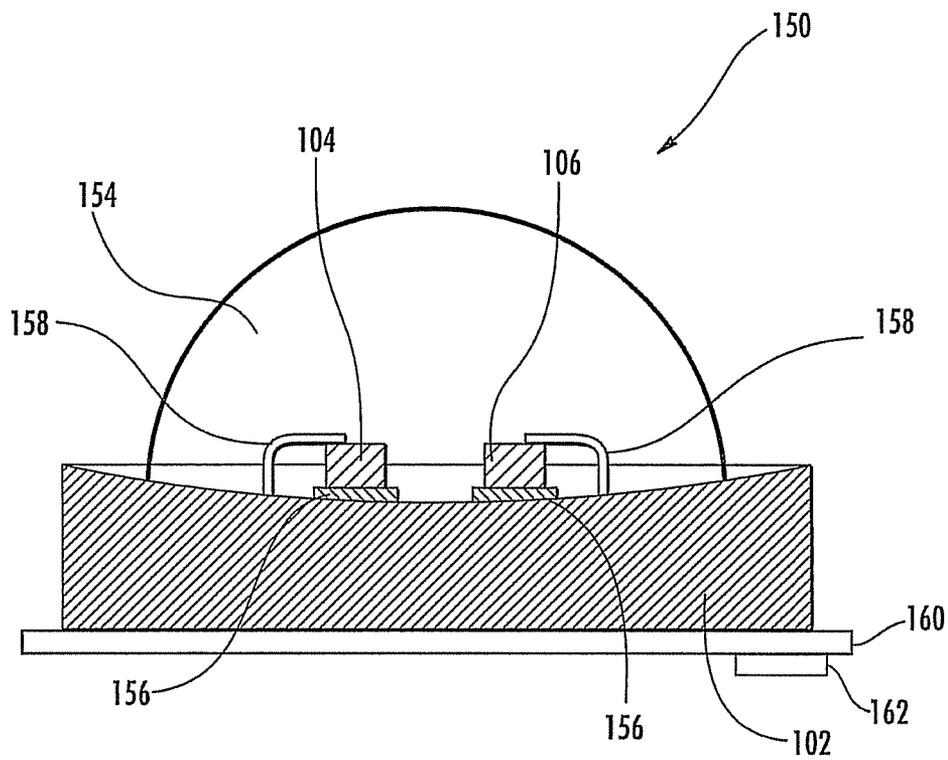


FIG. 3

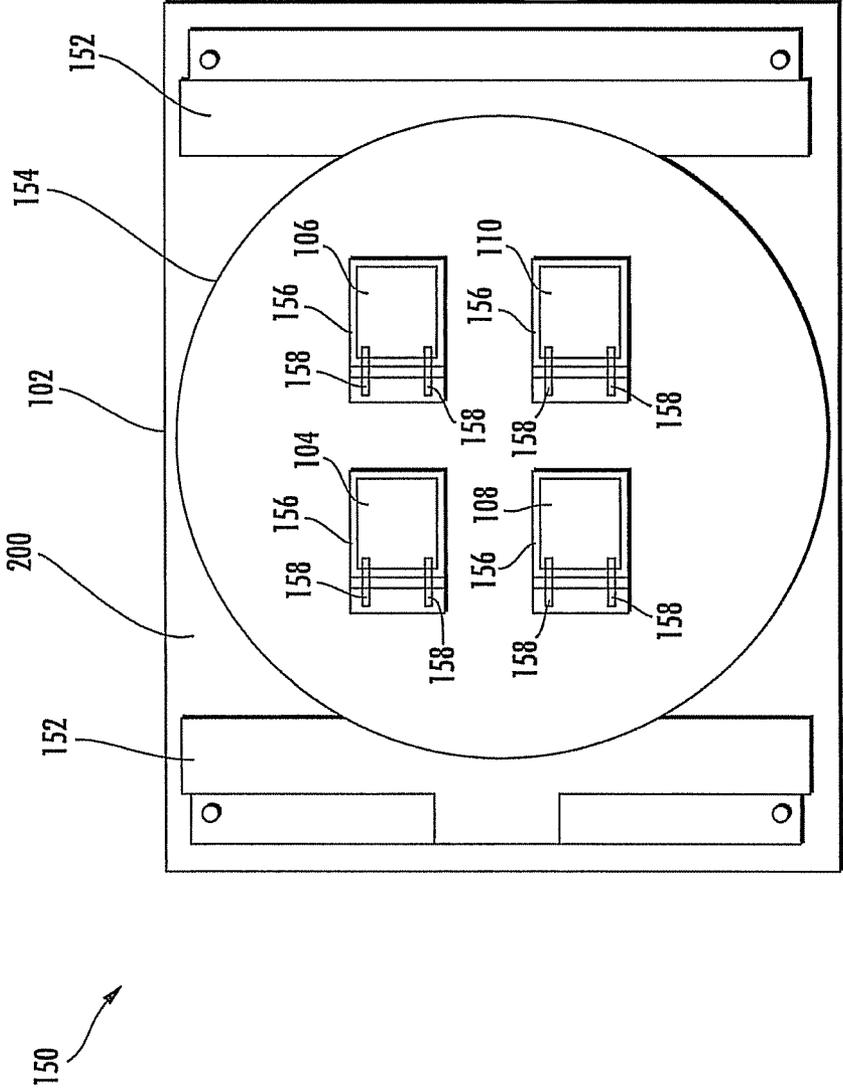


FIG. 4

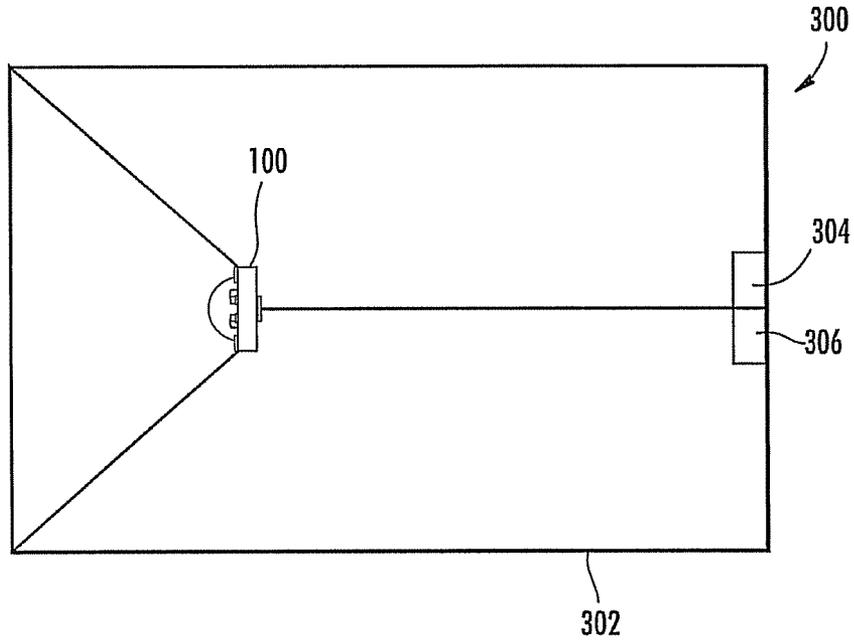


FIG. 5A

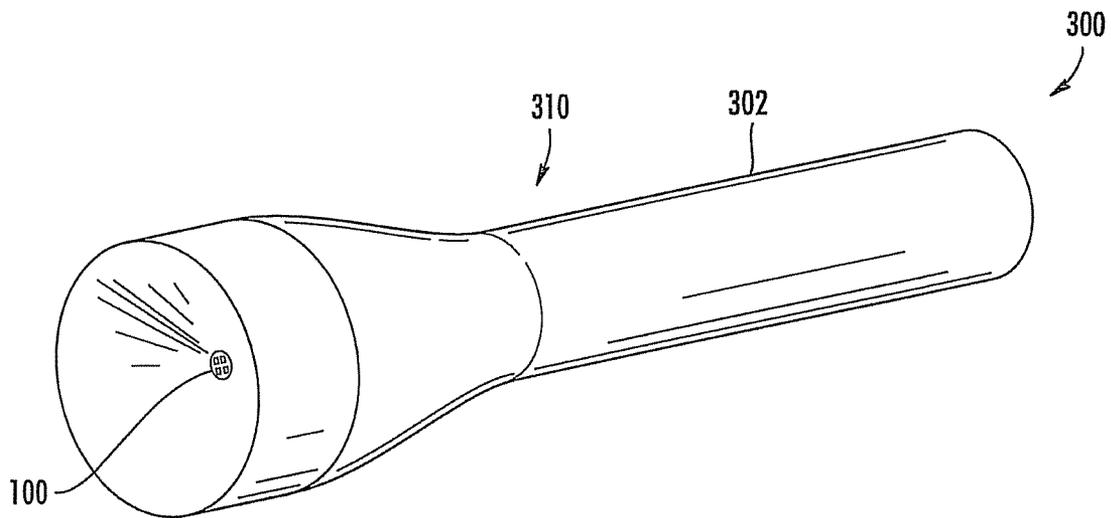


FIG. 5B

SINGLE MULTI-CHIP LAMP SOURCES AND RELATED METHODS

RELATED APPLICATIONS

The present application is a continuation of and claims the benefit to the filing date of U.S. patent application Ser. No. 11/903,806, filed Sep. 25, 2007 now U.S. Pat. No. 7,802,901, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The subject matter described herein relates to semiconductor light emitting devices. More particularly, the subject matter described herein relates to multiple light emitting device chips configured to a single substrate that can be housed in a lighting unit and related methods.

BACKGROUND

Semiconductor light emitting devices, such as a light emitting diode (LED), may be provided in a package for protection, color selection, focusing, and the like for light emitted by the device. An LED package generally includes a substrate member on which an LED is mounted. The LED may include a mounting pad attached to the substrate member with electrical connections being made to the LED for applying an electrical bias. LEDs generally comprise an active region of semiconductor material sandwiched between two oppositely doped layers. When a bias is applied across the doped layers, holes and electrons are injected into the active region where they recombine to generate light. Light is emitted omnidirectionally from the active layer and from all surfaces of the LED. The substrate member may also include traces or metal leads for connecting the package to external circuitry and the substrate may also act as a heat sink to conduct heat away from the LED during operation.

An LED package may include a lens positioned for receiving light emitted by an LED in the package. The lens may include optical materials intended to influence or change the nature of the light emitted by the LED. Further, the lens may be suitably shaped for scattering the light and/or otherwise redirecting or influencing the light.

Increasingly, LED packages are finding their way into everyday commercial products such as flashlights, spotlights, safety vehicle lighting, and internal vehicle lighting systems. For various reasons, devices providing a range of light beam colors are sought by military personnel, law enforcement personnel, and hunters. For example, red light can be used on vessels and helicopters at night so as not to disturb night vision of the human eye while still allowing maneuverability. Also, blue light can be used to differentiate and follow certain liquids (e.g., blood, oil, hydraulic fluid, etc.) since particular liquids absorb blue light wavelengths differently. This can be advantageous for hunters tracking animal blood when visibility is limited or automotive technicians seeking the source of an oil leak.

LED packages provide a challenge in effecting the different color beams needed for these various applications. In current lighting units, beam filters are mechanically attached and employed to filter white light for providing the various color beams. The beam filters can be either added to the light in front of a lens as a mechanical attachment or by some other design intent. Typically, as described in U.S. Pat. No. 6,761,467 to Matthews et al., the beam filters operate on a flip-up design that allows a quick transition back to a white light

beam. In other aspects, the beam filters operate by rotating the lens in front of the light source, which is offset from the central body axis, to allow selection of multiple beam filters by rotation of the lens.

Additionally, multiple color lamps can be positioned inside lighting units such as flashlights to provide various color beams. These lighting units change colors, however, by activating individual lamps wherein each individual lamp comprises a single chip emitting a single color. This configuration of multiple lamps does not approach the brightness needs or reflector efficiency required for these lighting units. Also, the use of multiple lamps is limited by size constraints of the lighting unit such that the lamps are off-centered, leading to beam shifting. It is therefore desirable to provide improvements in LED lighting units capable of emitting multiple color light beams. Particularly, it would be beneficial to eliminate the use of beam filters and multiple lamps within the lighting unit housing.

Accordingly, there exists a long-felt need for LED multi-chip lighting units and related methods that provide improvements in lighting units employing various color light beams as well as the powering properties afforded by LEDs versus traditional gas filled lighting sources.

SUMMARY

According to the present disclosure, novel LED multi-chip lighting units and related methods are provided for emitting individually selectable colored light beams while also providing a dual-output white light beam.

It is therefore an object of the present disclosure to provide LED multi-chip lighting units and related methods for emitting individually selectable colored light beams without the use of beam filters or individual color lamps.

An object having been stated above, and which is achieved in whole or in part by the subject matter disclosed herein, other objects will become evident as the description proceeds when taken in connection with the accompanying drawings as best described hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the subject matter described herein will now be explained with reference to the accompanying drawings of which:

FIG. 1 is a top plan view of a multi-chip lamp source assembly according to an embodiment of the subject matter described herein;

FIG. 1A is a top plan view of an alternative embodiment to FIG. 1;

FIG. 2 is a cross-sectional side view of a multi-chip lamp having a substantially flat substrate surface according to the subject matter described herein;

FIG. 3 is a cross-sectional side view of a multi-chip lamp having a concave substrate surface according to the subject matter described herein;

FIG. 4 is a top plan view of a substrate and a red LED chip, a blue LED chip, a green LED chip, and a white LED chip according to the subject matter described herein;

FIG. 5A is a cross-sectional view of a lighting unit using a substrate and a red LED chip, a blue LED chip, a green LED chip, and a white LED chip according to the subject matter described herein; and

FIG. 5B is a perspective view of a lighting unit using a substrate and a red LED chip, a blue LED chip, a green LED chip, and a white LED chip according to the subject matter described herein.

DETAILED DESCRIPTION

Light emitting device multi-chip lighting units and related methods are described herein with reference to FIGS. 1-4. As illustrated in FIGS. 1-4, some sizes of structures or portions may be exaggerated relative to other structures or portions for illustrative purposes and, thus, are provided to illustrate the general structures of the subject matter disclosed herein. Further, various aspects of the subject matter disclosed herein are described with reference to a structure or a portion being formed on other structures, portions, or both. As will be appreciated by those of skill in the art, references to a structure being formed "on" or "above" another structure or portions contemplates that additional structure, portion, or both may intervene. References to a structure or a portion being formed "on" another structure or portion without an intervening structure or portion are described herein as being formed "directly on" the structure or portion.

Furthermore, relative terms such as "on" or "above" are used herein to describe one structure's or portion's relationship to another structure or portion as illustrated in the Figures. It will be understood that relative terms such as "on" or "above" are intended to encompass different orientations of the device in addition to the orientation depicted in the Figures. For example, if the device in the Figures is turned over, structure or portion described as "above" other structures or portions would now be oriented "below" the other structures or portions. Likewise, if the device in the Figures is rotated along an axis, structure or portion described as "above" other structures or portions would now be oriented "next to" or "left of" the other structures or portions. Like numbers refer to like elements throughout.

According to one aspect of the subject matter disclosed herein, a multi-chip lamp source assembly is provided that can be housed within a lighting unit such as a flashlight. The lighting unit can include the multi-chip lamp source assembly, a power supply source operably configured to the multi-chip lamp source assembly, and a housing that can carry the multi-chip lamp source assembly and the power supply source. The multi-chip lamp source assembly can include a semiconductor substrate adapted for attachment of multiple light emitting device chips. A red LED chip can be attached to the semiconductor substrate and can emit a substantially red light beam. A blue LED chip can be attached to the semiconductor substrate and can emit a substantially blue light beam. A green LED chip can be attached to the semiconductor substrate and can emit a substantially green light beam. A white LED chip can be attached to the semiconductor substrate and can emit a substantially white light beam having a first intensity. In use, the assembly can be housed in lighting fixtures such as, for example, a flashlight to provide various lighting effects for numerous applications.

As used herein, the term "light emitting device" may include an LED, laser diode, and/or other semiconductor device which includes one or more semiconductor layers, which may include silicon, silicon carbide, gallium nitride and/or other semiconductor materials, a substrate which may include sapphire, silicon, silicon carbide and/or other micro-electronic substrates, and one or more contact layers which may include metal and/or other conductive layers. The design and fabrication of semiconductor light emitting devices is well known to those having skill in the art and need not be described in detail herein. For example, the semiconductor light emitting device may be gallium nitride-based LEDs or lasers fabricated on a silicon carbide substrate such as those devices manufactured and sold by Cree, Inc. of Durham,

N.C., although other light emitting devices from other material systems may also be used.

FIG. 1 is a top plan view of a multi-chip lamp source assembly, generally designated 100, according to an embodiment of the subject matter described herein. Referring to FIG. 1, multi-chip lamp source assembly 100 can include a substrate 102 and a four chip array. The four chip array can comprise a red LED chip 104, a blue LED chip 106, a green LED chip 108, and a white LED chip 110 (collectively, "LED chips"). In other aspects, multiple chips emitting the same color light beam can be positioned on substrate 102 such that more than four chips are used. For example, two red LED chips, two blue LED chips, and two green LED chips can be used in addition to a single white LED chip.

There can be numerous possible configurations and combinations of chips, provided that there is at least one red, one blue, one green, and one white LED chip. FIG. 1A is a top plan view of a multi-chip lamp source assembly, generally designated 200, comprising substrate 202, red LED chip 204, blue LED chip 206, green LED chip 208, and white LED chip 210.

Multi-chip lamp source assembly 100 can provide a source for an LED lamp and lighting unit such as, for example, a flashlight having multiple powering options. White LED chip 110 can be used to produce a powerful white light beam having a first intensity. LED chips 104, 106, 108, 110 can be activated together to produce a white light beam having a second intensity with a higher luminance than the white light beam produced and emitted by white LED chip 110 individually. Red LED chip 104, blue LED chip 106, and green LED chip 108 can be powered simultaneously to also produce a third intensity of medium luminance white light beam. Thus, a multi-output brightness can be provided, which can give flexibility to a user for selecting brightness. Additionally, red LED chip 104, blue LED chip 106, and green LED chip 108 can each be individually activated by the user to provide its respective colored light beam.

Substrate 102 can be a semiconductor substrate material such as, for example, silicon, copper, silver, FR4, aluminum, thermally conductive polycarbonate, or other suitable material. Substrate 102 may be formed of many different materials, including electrically insulating materials. Suitable substrate materials also can include, but are not limited to, ceramic materials such as aluminum nitride (AlN) and alumina (Al₂O₃). Dimensions of substrate 102 can vary widely depending on application and processes used to manufacture multi-chip lamp source assembly 100. For example, in the illustrated embodiment, substrate 102 may have dimensions ranging from fractions of millimeters (mm) to tens of millimeters.

With continuing reference to FIG. 1, LED chips 104, 106, 108, 110 can be operably connected to substrate 102. LED chips 104, 106, 108, 110 can be centered and symmetrically positioned on substrate 102. Proper alignment of LED chips 104, 106, 108, 110 can advantageously prevent shifting of a given light beam emitted from each chip. LED chips 104, 106, 108, 110 can be offset from the center in any symmetrical manner. LED chips 104, 106, 108, 110 can be equidistant angularly and evenly spaced so that the emitted beams overlap.

In this manner, beam filters can be eliminated from the lighting unit and the light source can remain virtually centered on substrate 102 while the user can easily switch between beam colors without add-on hardware. In one particular aspect, LED chips 104, 106, 108, 110 can be offset not more than 0.5 millimeters to eliminate beam shifting such that the emitted light can remain concentric regardless of the chip

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or chips emitting light. LED chips **104, 106, 108, 110** can be close enough in proximity to create a common beam and wherein the beam does not shift when the color or intensity changes. Also, additional chips can be used for additional lighting in various applications and can also be evenly spaced among the other chips on substrate **102**.

As shown in FIGS. **2** and **3**, a multi-chip lamp, generally designated **150**, can be formed using multi-chip lamp source assembly **100**. A masking layer **152** can be provided on top of substrate **102**. A dome lens **154** can be positioned over substrate **102** and LED chips **104, 106, 108** (not shown), **110** (not shown). Dome lens **154** can be constructed of an encapsulant material. The encapsulant material can be any suitable type of resin material such as a silicone or epoxy-based material. The encapsulant material can be cured such that it remains in a form with a convex meniscus. Dome lens **154** can be clear such that LED chips **104, 106, 108, 110** emit their true color light beams.

In other aspects, dome lens **154** can be phosphor shaded or colored such as, for example, a green lens. In one embodiment where dome lens **154** is green, blue LED chip **106** can provide a powerful white light beam and white LED chip **110** can emit a green light beam. These embodiments can be configured in a number of ways to emit a white light beam, red light beam, blue light beam, and green light beam. Thus, for example, a red light beam can be emitted from source assembly **200** with various predetermined combinations of chip colors, encapsulant material colors, or lens colors. The same applies to blue, green, and white light beams.

LED chips **104, 106, 108, 110** can be mounted on mounting pads **156** attached to the top of substrate **102**. Mounting pads **156** can be mounted to substrate **102** with electrical connections being made to LED chips **104, 106, 108, 110** for applying an electrical bias. A top surface of each of LED chips **104, 106, 108, 110** can be connected to electrical connections by conductive bond wires **158**.

Referring to FIG. **2**, the top of substrate **102** can be a simple flat substrate wherein LED chips **104, 106, 108, 110** are placed on the level surface. This configuration can allow for light to potentially be lost out the sides unless a reflective lens surface in the light is used to compensate. Referring to FIG. **3**, the top of substrate **102** can be designed to include a curved surface as known in the art. The curvature can allow for more lumens to be directed through dome lens **154** instead of losing a portion of the light through the sides. Additionally, a larger more traditional reflective flash light surface can then be used to further focus the light beam.

FIG. **4** is a top plan view of substrate **102** and LED chips **104, 106, 108, 110**. Referring to FIG. **4**, substrate **102** includes a top surface **200** and mounting pads **156**. LED chips **104, 106, 108, 110** can be mounted to mounting pad **156**. Electrical traces can provide electrical connection to LED chips **104, 106, 108, 110** either through a submount (not shown) or by bond wires **158**. Other aspects of LED packaging and structure not shown or described can be employed by those of ordinary skill in the art. These aspects can include, but are not limited to couplers, electrical traces, and conductive portions.

A control chip **101** as shown in FIGS. **1** and **2** can be operably configured to multi-chip lamp source assembly **100** to regulate output for thermal purposes and power consumption. The control chip **101** can be mounted on the substrate front-side or back-side, in a tail section of the lighting unit, or any other suitable location. The control chip **101** can be used to allow individual color selection of LED chips **104, 106, 108, 110** by individually actuating each chip. The control chip **101** can also control the voltage supplied to LED chips **104,**

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106, 108, 110 for varying the brightness emitted thereby, wherein brightness for each of the colors can be adjustable. Such a dimming function is desirable because white light that is too bright can be extremely intense and create long shadows. Furthermore, the control chip **101** can be used to allow output of both a white light having a first intensity and a more intense white light having a second intensity. Also, the control chip **101** can be used in the lighting unit to allow for types of controls for signaling or general use such as for example a red strobe light, a green strobe light, a blue strobe light, a white strobe light, or a more intense white strobe light.

In use, multi-chip lamp source assembly **100** can be configured with circuitry **160** (see FIG. **3**), **304** (see FIG. **5A**) for actuating LED chips **104, 106, 108, 110** individually and sets of chips such that the lighting unit can function in the desired manner without the use of filters or multiple lamps. The circuitry **160, 304** can include a power supply **162** (see FIG. **3**), **306** (see FIG. **5A**) and logic as known to those of skill in the art. Multi-chip lamp source assembly **100** can be used as the light source for an LED lamp that can be housed in a housing **302** of a lighting unit **300** (see FIGS. **5A** and **5B**) such as for example a flashlight **310** (see FIG. **5B**) or a lantern. Positioning LED chips **104, 106, 108, 110** on a single substrate **102** and having a single dome lens **154** can eliminate the need for multiple LED lamps within a lighting unit housing. Such prior configurations are limited by physical constraints on the size of the housing and placement of the LED lamps. Furthermore, these prior configurations position the LED lamps off-center, which can lead to beam shifting when changing beam colors. As such, it is advantageous to position LED chips **104, 106, 108, 110** on a single substrate **102** to provide a single lamp with the features describe herein.

As controlled by the control chip, LED chips **104, 106, 108, 110** can be individually actuated by the user, usually by some mechanical switch or knob attached to the lighting unit. White LED chip **110** can be turned to an ON position such that white LED chip **110** can emit a white light having a first intensity. It is desirable to have multiple intensities, such as a high and low setting, of white light available for use in various circumstances. To that end, LED chips **104, 106, 108, 110** can be activated simultaneously to provide a white light having a second intensity greater than that of the first intensity. The light emitted from red LED chip **104**, blue LED chip **106**, and green LED chip **108** combine to form the white light that is further combined and added to the light emitted by white LED chip **110** to provide the white light having a second intensity greater than that emitted by white LED chip **110** alone. In this manner, multi-chip lamp source assembly **100** can provide multi-output white light.

As mentioned hereinabove, LED chips **104, 106, 108, 110** can be centered and aligned such that the beams substantially overlap and that when red, blue, and green light beams overlap they provide a white light beam. Thus, in one particular embodiment, the lighting unit can provide a red light beam, a blue light beam, a green light beam, a low intensity white light beam, and a high intensity white light beam. Red LED chip **104**, blue LED chip **106**, and green LED chip **108** can be actuated simultaneously without white LED chip **110** to provide a white light having a third intensity that has a luminance of medium intensity between the first and second intensities.

The intensities of each of these colored beams can be varied by using the control chip. Additionally, the control chip can be configured to provide a strobe light effect. Such applications for this function can include a blue strobe light for law enforcement to use while on foot or directing traffic, a green strobe light for signaling, a red strobe light for signaling during night operations, and a white low intensity strobe light

for day signaling. Also, a medium and high intensity white light beam, as described hereinabove, can be utilized to provide a white strobe light with two additional intensities.

Thus, lighting units configured with multi-chip lamp source assembly **100** can provide various color beams and intensities for use in a lighting unit without the need for filters or multiple lamps to provide multiple color beams. Instead, multi-chip lamp source assembly **100** can employ LED chips **104, 106, 108, 110** on a single substrate and under a single dome lens such that only one LED lamp is needed within the lighting unit to provide the various colored light beams and a multi-output white light beam. Thus, a flashlight having multi-color beams and multi-output white light beams can be achieved by using a single LED lamp having LED chips **104, 106, 108, 110** on a single substrate, rather than providing multiple lamps or beam filters as previously used.

It will be understood that various details of the presently disclosed subject matter may be changed without departing from the scope of the presently disclosed subject matter. Furthermore, the foregoing description is for the purpose of illustration only, and not for the purpose of limitation.

What is claimed is:

1. A multi-chip lamp source comprising:
a substrate; and
at least three light emitting diode (LED) chips operably configured to the substrate to form a single LED package, the LED chips comprising at least three different colored LED chips, and being configured to be actuable both individually and together to emit selectable colored light, and the LED chips being positioned on the substrate such that the emitted light remains concentric without shifting regardless of the chip or chips emitting the light.
2. The multi-chip lamp source of claim 1, wherein the at least three LED chips are centered symmetrically on the substrate.
3. The multi-chip lamp source of claim 1, wherein the at least three LED chips comprise:
at least one white LED chip operably configured to the substrate to emit substantially white light;
at least one red LED chip operably configured to the substrate to emit substantially red light;
at least one blue LED chip operably configured to the substrate to emit substantially blue light; and
at least one green LED chip operably configured to the substrate to emit substantially green light.
4. The multi-chip lamp source of claim 3, wherein the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip are configured to be actuated individually and the at least one white LED chip can be individually actuated to emit substantially white light having a first intensity.
5. The multi-chip lamp source of claim 4, wherein the at least one white LED chip is configured to emit light simultaneously with the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip to emit substantially white light having a second intensity.
6. The multi-chip lamp source of claim 5, wherein the second intensity is greater than the first intensity, thereby providing multi-output brightness.
7. The multi-chip lamp source of claim 5, wherein the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip are configured to emit light simultaneously that overlaps to emit substantially white light having a third intensity.

8. The multi-chip lamp source of claim 1, further comprising a control chip operably configured to the substrate and at least three LED chips.

9. The multi-chip lamp source of claim 8, wherein the control chip is configured to regulate thermal output and power consumption.

10. The multi-chip lamp source of claim 8, wherein the control chip is configured to control the intensity of the light emitted by the at least three LED chips.

11. A multi-chip lamp source comprising:

- a substrate having a first side;
- at least one white light emitting diode (LED) chip operably configured to the first side of the substrate to emit substantially white light;
- at least one red LED chip operably configured to the first side of the substrate to emit substantially red light;
- at least one blue LED chip operably configured to the first side of the substrate to emit substantially blue light;
- at least one green LED chip operably configured to the first side of the substrate to emit substantially green light; and
- a lens positioned over the first side of the substrate and the lens positioned above the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip to thereby encase each chip within the lens; and

wherein the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip, and the at least one green LED chip are configured to be actuable to create multiple colored light and the LED chips are positioned on the substrate such that the emitted light remains concentric without shifting regardless of the chip or chips emitting the light.

12. The multi-chip lamp source of claim 11, wherein the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip are configured to be actuated individually and said at least one white LED chip can be individually actuated to emit substantially white light having a first intensity.

13. The multi-chip lamp source of claim 12, wherein the at least one white LED chip is configured to emit light simultaneously with the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip to emit white light having a second intensity.

14. The multi-chip lamp source of claim 13, wherein the second intensity is greater than the first intensity, thereby providing multi-output brightness.

15. The multi-chip lamp source of claim 13, wherein the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip are configured to emit light simultaneously that overlaps to provide white light having a third intensity.

16. The multi-chip lamp source of claim 11, further comprising a control chip operably configured to the substrate, the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip.

17. The multi-chip lamp source of claim 16, wherein the control chip is configured to regulate thermal output and power consumption.

18. The multi-chip lamp source of claim 16, wherein the control chip is configured to control the intensity of the light emitted by the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip.

19. A method of forming a multi-chip lamp source, the method comprising:

providing a substrate;

configuring at least three light emitting diode (LED) chips to the substrate in positions such that emitted light remains concentric without shifting regardless of the chip or chips emitting the light; and

wherein the LED chips comprising at least three different colored LED chips are configured to be actuatable both individually and together to emit selectable colored light.

20. The method of claim 19, wherein the at least three LED chips comprise:

at least one white LED chip operably configured to the substrate to emit substantially white light;

at least one red LED chip operably configured to the substrate to emit substantially red light;

at least one blue LED chip operably configured to the substrate to emit substantially blue light; and

at least one green LED chip operably configured to the substrate to emit substantially green light.

21. The method of claim 20, further comprising attaching the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip in a centered and symmetrical configuration on the substrate.

22. The method of claim 20, further comprising operably configuring a control chip to the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip and the at least one green LED chip for actuating individual chips and sets of chips in order to selectively emit one of substantially red light, substantially blue light, substantially green light, a first intensity white light, a second intensity white light, and a third intensity white light.

23. The method of claim 19, further comprising attaching a control chip to the substrate for regulating thermal output and power consumption.

24. The method of claim 19, further comprising securing a lens on the substrate over the at least one white LED chip, the at least one red LED chip, the at least one green LED chip and the at least one blue LED chip to thereby encase each chip within the lens.

25. A multi-chip lamp source comprising:

a single substrate having a center;

at least five or more unpackaged chips disposed over the single substrate, wherein the at least five chips comprise:

a first white light emitting diode (LED) chip operably configured to the substrate to emit substantially white light;

a second red LED chip operably configured to the substrate to emit substantially red light;

a third blue LED chip operably configured to the substrate to emit substantially blue light; and

a fourth green LED chip operably configured to the substrate to emit substantially green light; and

a fifth control chip operably configured to the substrate and to each of the first, second, third, and fourth LED chips; and

a single lens provided over the substrate and over each of the at least five chips to thereby encase each chip within the single lens;

wherein the first, second, third, and fourth LED chips are each configured equidistant from the center of the substrate; and

wherein the control chip is configured to actuate each of the first, second, third, and fourth LED chips and sets of LED chips for providing one of a substantially red light

beam, a substantially blue light beam, a substantially green light beam, a first intensity white light beam, a second intensity white light beam, and a third intensity white light beam.

26. The lamp source of claim 25, wherein the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip, and the at least one green LED chip are configured in a centered and symmetrical configuration on the substrate.

27. The lamp source of claim 25, wherein the at least one white LED chip, the at least one red LED chip, the at least one blue LED chip, and the at least one green LED chip are positioned on the substrate such that emitted light remains concentric without shifting regardless of the chip or chips emitting the light.

28. A multi-chip lamp source comprising:
a substrate;

at least three light emitting diode (LED) chips operably configured to the substrate to form a single LED package, the LED chips comprising at least three different colored LED chips, and being configured to be actuatable both individually and together to emit selectable colored light and the LED chips being positioned on the substrate such that emitted light remains concentric without shifting regardless of the chip or chips emitting the light; and

a lens on the substrate over the at least three LED chips to thereby encase each chip within the lens.

29. The lamp source of claim 28, wherein the at least three LED chips are selected from a group consisting of a white LED chip, a red LED chip, a blue LED chip and a green LED chip.

30. The lamp source of claim 28, wherein the at least three LED chips comprise at least one white LED chip, at least one red LED chip, at least one blue LED chip and at least one green LED chip configured in a centered and symmetrical configuration on the substrate.

31. The lamp source of claim 28, wherein the at least three LED chips are configured to be actuatable to create white light of at least two different intensities.

32. A multi-chip lamp source comprising:

a single substrate comprising a first surface;

at least three unpackaged light emitting diode (LED) chips operably configured and directly attached to the first surface of the single substrate, the LED chips comprising at least three different colored LED chips wherein one of the LED chips is a white LED chip, the LED chips being configured to be actuatable both individually and together to emit selectable colored light;

at least one control chip operably configured and directly attached to the first surface of the single substrate and operably configured to each LED chip, wherein the control chip is configured to actuate each LED chip, either individually or together, for providing multiple different colored beams of light and wherein the control chip is configured to control the voltage supplied to each LED chip for controlling a brightness of each LED chip; and a single lens disposed over the first surface of the substrate, the control chip, and over each of the at least three LED chips to thereby encase the LED chips within the single lens.

33. The lamp source of claim 32, wherein the at least three LED chips are selected from a group consisting of a white LED chip, a red LED chip, a blue LED chip and a green LED chip.

34. The lamp source of claim 32, wherein the at least three LED chips comprise at least one white LED chip, at least one

red LED chip, at least one blue LED chip and at least one green LED chip configured in a centered and symmetrical configuration on the substrate.

35. The lamp source of claim 32, wherein the at least three LED chips are actuatable to create white light of at least two different intensities.

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